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COMMON DISEASES OF APPLES, PEARS AND QUINCES.

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NEW JERSEY

AGRICULTURAL

Experiment Stations

CIRCULAR 44

New Brunswick, N. J.

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Common Diseases of Apples, Pears and Quinces.*

Fig. 1. *Crown Gall on Cherry.*
(From Circular 34, New Jersey Agricultural Experiment Station)

This circular is intended to familiarize the fruit growers of the state with the most common diseases of the pomaceous fruits and the latest and most satisfactory treatments. Some of these diseases are very injurious, while others are of little importance. The severity of some of them depends largely upon the climatic conditions and, therefore, they are much more destructive some years

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than others. All parts of the tree: root, trunk, branches, foliage, flowers and fruits are subject to the attack of fungus and bacterial pests and must be given careful attention. Sometimes the disease of one part makes itself manifest in another part of the tree. The time to begin combatting these pests is in the selection of the trees. Select good, healthy, vigorous trees; give careful attention to the setting, cultivation and fertilization; and give the recognized spray treatments for the control of the fungus diseases.

Crown Gall and Hairy Root (*Pseudomonas tumefaciens* S. & T.). (Figs. 1, 2, 3, 4.) These two bacterial diseases of apple,

Fig. 2. *Healthy Tree with Knot on Left.*
Tree with Crown Gall on Right.
(From Circular 34, N. J. Agricultural Experiment Station)

pear and quince are due to the same organism. The term "crown gall" is used because the disease was first described as occurring at the crown of the tree, but it is now recognized as occurring on roots, trunks and branches, and the so-called "hairy root" is recognized as a form of the same disease. The *galls* on the roots and at the crown may be more or less spherical or flattened. The flattened type is frequently covered with a mass of hair-like roots. They are most injurious when at the crown. The *hairy root* type appears

as a mass of roots usually arising from a flattened callous-like gall and frequently extend at right angles to the longitudinal axis of the root. The *aerial* form appears on the trunk either as rather smooth protuberances or as circular, flattened, rough areas, covered with papillae. This disease weakens the tree, requires more fertilizer to feed it, makes some varieties less productive and causes them to be much more easily blown out by wind storms. Some varieties, es-

Fig. 3. *Apple Tree with Hairy Root.*
(From Circular 34, N. J. Agricultural Experiment Station)

pecially the Wealthy, Yellow Transparent, Wolf River, Ben Davis, Northern Spy, and Williams Early Red, are more susceptible than most other varieties. This disease also attacks peach, plum, cherry, raspberry, blackberry, rose, grape, poplars, willows, daisy, and many other plants. There is no satisfactory method of control except the destruction of the diseased plants. *Do not set trees*

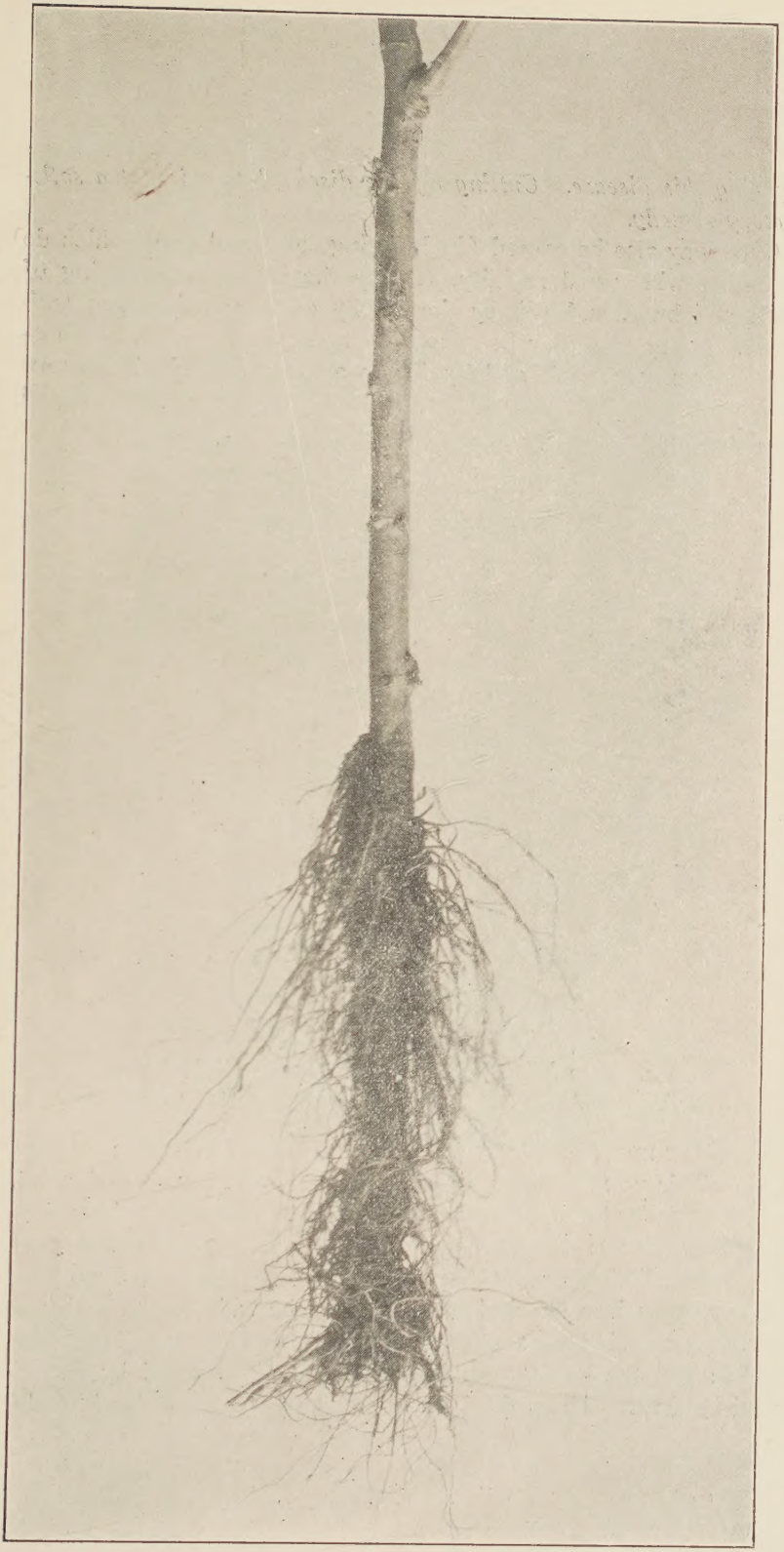

Fig. 4. *Young Tree with Hairy Root.*
Also Showing the Aerial Form of the Disease.
(From Circular 34, N. J. Agricultural Experiment Station)

showing this disease. Cutting off the diseased part is not a satisfactory remedy.

Galls may also be caused (1) by using stock and scion which do not grow with equal rapidity, (2) by the improper wrapping of graft and buds, and (3) by the woolly aphis (*Schizoneura lanigera*). Hairy root may be caused by breaking the roots in transplanting nursery stock and by heavy applications of nitrogenous fertilizers. They should not be confused with the true crown gall and hairy root caused by *P. tumefaciens.*

Fig. 5. *Fire Blight of the Pear. Twig Blight Form.*
(After Whetzel & Stewart in Bul. 272, Cornell Agri. Exp. Station)

Fire Blight (*Bacillus amylovorus* (Burr) De Toni). (Figs. 5, 6.) This very common disease attacks many varieties of pears, a few varieties of apples, and the quince. There are four well recognized forms: (1) the *blossom blight,* which appears soon after blossoming, killing the blossom and young leaf tufts and working its way down into the fruit spures; (2) the *twig blight,* which is the most conspicuous and most generally recognized. The twigs blacken and the leaves turn black as though scorched by fire or killed by frost. These dead leaves cling to the shoot far into the

winter, after the leaves from the healthy parts have fallen. The diseased twigs frequently show small drops of a white, sticky substance which becomes yellow and finally black; (3) the *fruit blight* usually originates from blossom infection, travels slowly back along the petioles of the young fruits, causing them to die, blacken and shrivel. It may also attack the fruit directly, probably being

Fig. 6. *Fire Blight of the Pear. Canker Form.*
(After Stewart in Bul. 329, Cornell Agri. Exp. Station)

carried by insects and gaining admission through slight wounds; (4) the *body blight* occurs on twigs, branches and trunk and may extend to the roots. It usually appears as blackened, slightly sunken areas. These areas or cankers frequently originate as a result of the disease traveling down twigs or water sprouts; they

frequently girdle the tree, causing its death, and are sometimes confused with winter injury.

The bacteria which cause this disease live through the winter in the cankers and sometimes in the twigs; multiply rapidly in the spring and spread to surrounding healthy tissues. They are found in the sticky, white exudation previously referred to and are carried by insects and by pruning tools.

It is much more severe on soft, rapidly growing stock and of much less importance on the old or on hard growths. It is much more severe on some varieties than on others, the Bartlett pear and

Fig. 7. *Black Rot of the Apple on the Fruit.*
(From 1913 Report, N. J. Agricultural Experiment Station. Photograph by Professor Blake)

the Yellow Transparent apple being among the most susceptible varieties.

Spraying is of little or no value as a control but the disease can be held in check in the orchard by the following practices:

1. Winter prune and burn all diseased twigs, being careful to cut well back of the disease. These twigs can be recognized by the fact that the leaves usually cling to them after the leaves have fallen from the healthy twigs.

2. Cut out the canker and burn. Paint the wound with corrosive sublimate (1 part in 1,000 parts of water) or with 5% formaldehyde solutions, which can be obtained at any drug store. When dry, paint with white lead paint or coal tar.

3. During the summer cut out and burn the blighted tips as soon as possible. This may be impracticable in large orchards when the disease is exceptionally severe.

Fig. 8. *Black Rot of the Apple on the Branches*
(From 1913 Report, N. J. Agricultural Experiment Station)

4. Keep the water sprouts and young spurs rubbed from the trunk and large branches. When they become infected the disease works in and causes the body blight cankers.

5. Do not over-prune the trees. Develop open or spreading crotches.

6. Do not over-fertilize. Avoid rich, nitrogenous fertilizers. Phosphoric acid is valuable; it tends to harden the new growths.

7. Remove or treat the neighboring wild crab, hawthorn and other trees which carry the disease.

8. The pruning knife should be frequently dipped in 5% formalin to destroy such germs as may cling to it.

9. Nurserymen should eradicate it so far as possible from all stock. The grower should not set a tree showing any sign whatever of the disease.

Black Rot (*Sphaeropsis malorum* Peck). (Figs. 7, 8, 9.) This very common fungus disease attacks the fruit, branches and leaves of the apple and quince. On the fruit it causes a rather solid

Fig. 9. *Black Rot of the Apple on the Leaves.*
(From Circular 35, N. J. Agricultural Experiment Station)

black rot, which is later covered with minute black papillae, giving rise to masses of black spores. On the twigs it may resemble the fire blight, but on the branches and trunk it causes swellings followed by a decaying and falling away of the bark and frequently completely girdling the affected part and causing its death. In early stages the diseased parts show the minute papillae similar to those on the fruit. The leaf spots are more or less circular, and brownish in color. They can very readily be mistaken for spots due to other causes. The Baldwin, Greening, King, Astrakin, Lawver and

Star are especially susceptible. Diseased trees should not be set, the cankers should be removed and the wounds painted and the trees sprayed.

Bitter or Ripe Rot (*Glomerella rufomaculans* (Berk.) S. & von S.). (Fig. 10.) This fungus disease is very common on the fruit and branches of the apple. The fruit rot is usually softer than the black rot and usually a brown or tan color, sometimes black. The rotten spot grows more rapidly than the black rot and finally becomes more or less wrinkled. Masses of wet, pink spores ooze out, forming more or less well defined circles beginning at the center of the spot. The cankers on the twigs and branches cause a very pronounced roughening of the bark, but as a rule are not so large as

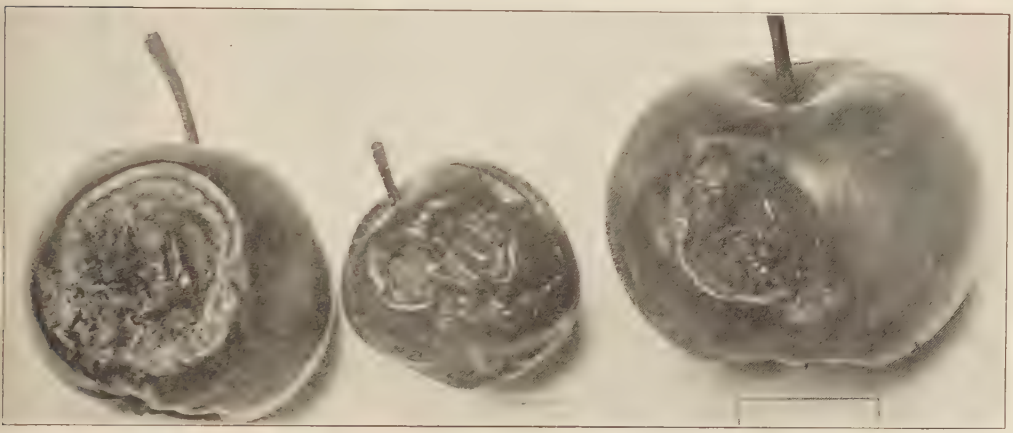

Fig. 10. *Bitter Rot of the Apple.*
(Photograph by Dr. J. J. Taubenhans)

the black rot cankers. The cankers should be cut out, the wounds painted and the trees sprayed.

Blossom End Rot (*Alternaria*). (Fig. 11.) This very troublesome rot appears in the late summer and fall and is the cause of considerable loss. It always originates at the blossom end, working inward, frequently causing a complete decay of the interior, while the outer part may appear perfect. The black rot sometimes behaves in a similar manner and the two are sometimes confused. There is no satisfactory treatment other than the regulation spraying.

Jonathan Spot Rot (*Alternaria sp.*). (Fig. 12.) This disease may appear in the orchard in the late summer or fall, but is most severe in storage. It develops in great abundance on fruit shortly after removal from storage. It occurs on the Jonathan, Wealthy, Spitzenberg, Nero, Smokehouse and Newton Pippin. There is no recognized satisfactory treatment.

Brown Rot (*Sclerotinia fructigena* (Pers) Nort.). This disease occasionally occurs on the apple and pear. It is the same, or very similar, to the brown rot of the peach. It is of no importance on either the apple or pear.

Pink Rot (*Cephalothecium roseum* Cda.). This is a storage rot occurring on scab spots and causing a whitish or pinkish mildew-

Fig. 11. *Blossom End Rot of the Apple.*
(From N. J. Agricultural Experiment Station.
Photograph by Professor Blake)

like growth. If the fruit is free from scab it is of very little importance.

Other Apple Rots. Storage rots due to *Penicilliums* and other organisms are very common.

Apple Scab (*Venturia inaequalis* (Cke.) Wint). (Figs. 13, 14.) This well known fungus disease attacks fruit, leaf and young shoot. It is most conspicuous on the fruit, where it first appears as peculiar green spots. The skin on these spots breaks, exposing the fungus which very soon becomes black. The spots enlarge and the centers become rusty. The diseased fruits are more or less irregular in shape and when the disease is severe are frequently cracked.

On the leaves and young twigs the fungus forms a velvety coat varying from olive green to black. The severity of this disease varies with the season; if damp at blooming time the disease will be much more severe than if dry at that time. The disease can be controlled by the proper spraying.

Pear Scab (*Venturia pyrina* Aderh). The pear scab is very similar to the apple scab and can be controlled in the same manner.

Blotch (*Phyllosticta solitaria* Ell & Er.). (Fig. 15.) This fungus disease of fruit, twig and leaf is frequently found in New Jersey, especially on Smith's Cider. It causes black spots with very irregular margins. In the center of these spots will be found a few minute black papillae, very similar to those on the black rot but not

Fig. 12. *Jonathan Spot of the Apple.*
(From 1913 Report, N. J. Agricultural Experiment Station. Photograph by Professor Blake)

nearly so abundant. On the new twigs it produces small, well defined, tan-colored spots bounded by a narrow red line. The leaf spots are small, irregular, light brown or yellowish or whitish, frequently bearing minute papillae.

Sooty Blotch (*Phyllachora pomigena* (Schw.) Sacc.). (Fig. 16.) This fungus causes irregular, dirty, sooty-like, or black blotches, which sometimes cover almost the entire fruit. It is superficial and may be rubbed off with a cloth. It does not injure the fruit for home uses but makes it unsightly and reduces the market value. It can be readily controlled by the usual spray treatments.

Flyspeck (*Leptothyrium pomi* (Mont. & Fr.) Sacc.). This fungus causes minute black dots resembling fly-specks on the surface of the apple. It is superficial and does not injure the fruit but reduces its market value. It can be controlled by the regular spray treatment.

Apple Rust (*Gymnosporangium macropus* Link.). (Figs. 17, 18.) The rust of the apple attacks the fruit, leaves and sometimes the very young shoots. It appears as a yellowish or orange colored spot, which gradually becomes darker, and on the surface of the fruit or under surface of the leaf gives rise to numerous pustules which are yellowish and finally black. When the disease is severe,

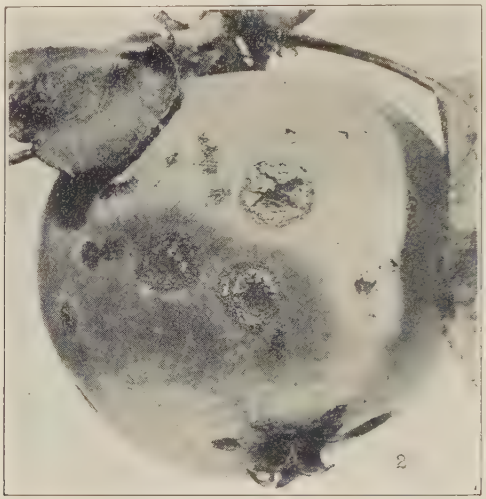

Fig. 13. *Apple Scab on the Fruit.*
(After Wallace, Cornell Agri. Exp. Station, Bul. 335)

the foliage is brownish in color. The spores of the fungus are produced in the pustules but, unlike the spores of most fungi of the apple, will not grow on the apple. They are carried by the wind to the red cedar, on which they cause the familiar dark brown "cedar apples." In the wet weather of spring these "cedar apples" give rise to gelatinous, horn-like projections containing many spores. These spores are carried to the apple and give rise to the apple rust as described above.

Pear Rust (*Gymnosporangium globosum* Farl.). The pear rust

is very similar to the apple rust. It is of very little importance in New Jersey.

Quince Rust (*Gymnosporangium germinale*). The rust on the quince resembles that on the apple, but frequently tends to cause pronounced swellings of the twigs.

Leaf Blight (*Fabraea maculata* (Lev.) Atk.). This fungus disease of the fruit and foliage of the pear is very abundant in New Jersey. On the fruit it appears as small red spots which soon become black and are frequently mistaken for scale insects. In severe cases it causes a cracking of the fruit. Small black spots are also

Fig. 14. *Apple Scab on the Leaves.*
(After Wallace, Cornell Agri. Exp. Station, Bul. 335)

formed on the leaves, frequently causing them to turn yellow or brown and fall.

Pear Leaf Spot (*Septoria piricola* Desm.). The spots caused by this fungus are rather angular in outline, ashy gray in color, and contain a few very minute black papillae. When severe this disease causes a falling of the foliage and a corresponding weakening of the tree.

Fruit Spot (*Cylindrosporium pomi* Brooks). This disease appears as slightly sunken discolored spots on the apple. It is of very little importance in this state.

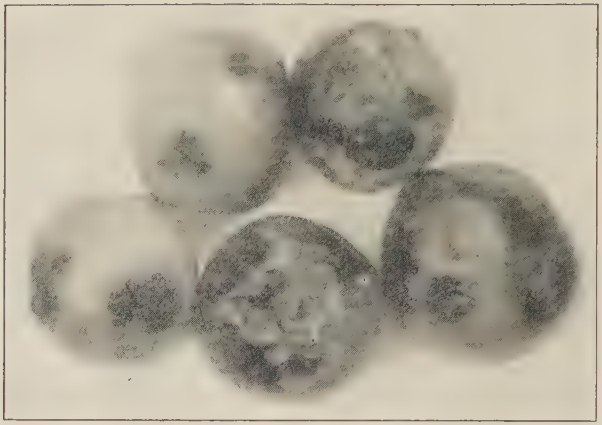

Fig. 15. *Apple Blotch.*
(From 1913 Report, N. J. Agricultural Experiment Station.
Photograph by Professor Blake)

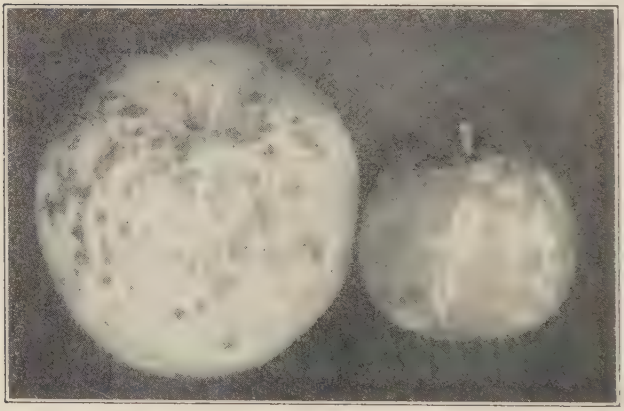

Fig. 16. *Sooty Blotch of the Apple.*
(From 1913 Report, N. J. Agricultural Experiment Station.
Photograph by Professor Blake)

Other Foliage Diseases. Other foliage diseases due to *Phyllostictas* and other organisms are of common occurrence. They can usually be controlled by the regular spray treatment.

Water Core. This disease is not well understood and there is no satisfactory treatment.

Mildew (*Sphaerotheca mali* (Duby) Burr). This fungus grows on the surface of the foliage covering it with a white or grayish growth. When well advanced numerous small black fruiting

Fig. 17. *Apple Rust on the Leaves.*
(Photograph by Dr. E. Meade Wilcox)

bodies appear. This disease is not very serious and can be readily controlled by using the spray treatment.

Winter Injury. Many trees suffer from winter injury at, or just above or below the surface of the ground. When very severe the trees die the first season, but when mild they may continue to grow and produce fruit for one or two years. Mounding the earth slightly around the base of the tree to give a good drainage will prevent much of this loss.

Fig. 18. *Cedar Rust.*
(Photograph by Dr. E. Meade Wilcox)

Spray Injury. Trees are frequently injured by improper spray mixture or by the improper applications. Growers should use the well recognized reliable treatments. Spraying, to be efficient protection and not injurious to the tree, should be at the right time and thorough.

Spraying.

In spraying the orchard four points should be kept in mind: (1) The time of application; (2) the material used; (3) the organism to be controlled; and (4) the thoroughness of the treatment.

(1) If the treatment is not given at the proper time, the results may be disappointing. The interval of time during which some organisms can be treated successfully may be very short, a few days or even a few hours.

(2) Some materials are better than others, but in all cases the line of treatment must be practical.

(3) Indiscriminate spraying is not profitable. The orchardist should know the object of this treatment. However, a clear, concise line of treatment for the season is desirable.

(4) The treatment should be thorough in order to be efficient. The dormant spray should hit every part of the tree where the pest is likely to find lodgment. All growing season sprays should be applied as a fine mist and the fruit and foliage should be well coated with small spots of the mixture. It is usually advisable to continue the spraying until the tree begins to drip. In spraying for fungus diseases the trunk and branches should be as thoroughly coated as possible. In spraying for plant lice, pear psylla, red bug and other sucking insects, the treatment must be so thorough that all the individual insects are drenched.

SPRAY CALENDAR FOR APPLES, PEARS AND QUINCES.

This spray calendar has been adopted by T. J. Headlee, Entomologist; M. A. Blake, Horticulturist, and Mel. T. Cook, Plant Pathologist, of the New Jersey Agricultural Experiment Station, as being the most satisfactory for New Jersey.

Time	Material	
1. Before the buds swell.	Commercial concentrated lime-sulphur 1 part in 9 parts water, or home-made concentrated lime-sulphur diluted to a specific gravity of 1.03.	For San José scale and fungus diseases.
2. As blossoms first show color.	Commercial concentrated lime-sulphur 5 quarts in 50 gals. water, or home-made concentrated lime-sulphur diluted to specific gravity 1.007+3 lbs. arsenate of lead paste (not less than 15% arsenic oxide).	For scab and other fungi and for bud moth and curculio. If plant lice or pear psylla are abundant at this time, add ¾ pint of "black leaf 40" tobacco extract to each 50 gallons of spray mixture.
3. Directly after petals fall.	Same as 2.	For fungus diseases, codling moth, curculio, canker worms and leaf chewers generally. For plant lice, pear psylla and red bug, use "black leaf 40" at rate recommended in 2.
4. Ten days after the blossoms fall.	Same as 2.	For codling moth, fungus diseases, curculio and leaf chewers generally. For plant lice and leaf hoppers use "black leaf 40" as above.
5. June 20th to 30th for all fall and winter varieties.	Same as 2.	For fungus diseases. codling moth and leaf chewers.